

CLAIMS

1. A method for determining a position of a remote terminal in a wireless communication network having included therein a plurality of transmitting sources, the method comprising:

obtaining a set of time measurements for a set of transmitting sources, wherein each time measurement is derived based on a transmission received at the remote terminal from a respective transmitting source that is either an origination source or a repeater associated with the origination source;

identifying a particular origination source for each received time measurement;

comparing a list of originating sources for the received time measurements against a list of probable origination sources for each of at least one repeater in the network; and

determining whether the remote terminal is under a coverage of a particular repeater based on a result of the comparing.

2. The method of claim 1, further comprising:

prior to the comparing, estimating whether the remote terminal is under the coverage of a repeater in the network.

3. The method of claim 1, further comprising:

forming a list of probable origination sources for each repeater within the network.

4. The method of claim 3, wherein the list of probable origination sources for each repeater is formed via empirical measurements at various locations within a coverage area of the repeater.

5. The method of claim 3, wherein the list of probable origination sources for each repeater is formed via measurements received from remote terminals operating within a coverage area of the repeater.

6. The method of claim 1, wherein the origination sources are base stations of a CDMA communication network.

7. A method for determining a position of a remote terminal in a
2 wireless communication network having included therein a plurality of
transmitting sources, wherein each transmitting source is either an origination
4 source for a transmission or a repeater associated with the origination source,
the method comprising:

6 cataloging an environment type for each repeater within the network;
obtaining a set of time measurements for a set of transmitting sources,
8 wherein each time measurement is derived based on a transmission received at
the remote terminal from either an origination source or its associated repeater;
10 and

determining whether the remote terminal is under a coverage of a
12 particular repeater based on the cataloged environment type for each repeater
and the received time measurements.

8. The method of claim 6, further comprising:

2 for each origination source within the network, identifying whether or
not the origination source is associated with at least one repeater.

9. The method of claim 6, wherein the environment type for each
2 repeater is cataloged based on a list of origination sources that may be received
while under the coverage of the repeater.

10. The method of claim 6, wherein the remote terminal is determined to
2 be under the coverage of the particular repeater if the received time
measurements are derived from a limited number of origination sources.

11. The method of claim 6, wherein the remote terminal is determined to
2 be under the coverage of the particular repeater if the received time
measurements are derived from one or two origination sources.

12. A method for determining a position of a remote terminal in a
2 wireless communication network having included therein a plurality of
transmitting sources, the method comprising:

4 obtaining at least one time measurement for at least one transmitting
source, wherein each received time measurement is derived based on a

- 6 transmission received at the remote terminal from a transmitting source that is
either an origination source or a repeater associated with the origination source;
8 determining a propagation delays associated with each received time
measurement;
10 comparing the propagation delays for each received time measurement
against a threshold value for the origination source associated with the time
12 measurement; and
determining whether the remote terminal is under a coverage of a
14 particular repeater based on a result of the comparing.

13. The method of claim 12, wherein the threshold value for a particular
2 origination source is derived based in part on an expected worst case
propagation delays for a transmission from the origination source to a
4 particular remote terminal located within the coverage of the origination
source.

14. The method of claim 12, wherein the threshold value for a particular
2 origination source is derived based in part on an expected best case
propagation delays for a transmission from the origination source via a
4 repeater to a particular remote terminal located within the coverage of the
repeater.

15. The method of claim 12, wherein the threshold value for a particular
2 origination source is selected to reduce a likelihood of erroneously identifying
the remote terminal as being under the coverage of a repeater associated with
4 the origination source.

16. A method for determining a position of a remote terminal in a
2 wireless communication network having included therein a plurality of
transmitting sources, the method comprising:

- 4 obtaining a set of time measurements for a set of transmitting sources,
wherein each time measurement is derived based on a transmission received at
6 the remote terminal from a transmitting source that is either an origination
source or a repeater associated with the origination source;
8 identifying a particular origination source for each received time
measurement;

- 10 determining whether the identified origination source for each received
time measurement is associated with a repeater;
- 12 discarding time measurements for selected ones of origination sources
determined to be associated with repeaters; and
- 14 determining an initial position estimate for the remote terminal based on
remaining time measurements not discarded.

17. The method of claim 16, further comprising:
- 2 retaining time measurement for a reference origination source even if the
reference origination source is associated with a repeater.

18. The method of claim 16, further comprising:
- 2 determining whether an origination source not associated with a
repeater is available for selection as a reference origination source for the
- 4 remote terminal.

19. The method of claim 18, further comprising:
- 2 discarding time measurements for origination sources associated with
repeaters if at least one origination source not associated with a repeater is
- 4 available for selection as the reference origination source for the remote
terminal.

20. The method of claim 18, further comprising:
- 2 retaining time measurements for origination sources associated with
repeaters if no origination source not associated with a repeater is available for
- 4 selection as the reference origination source for the remote terminal.

21. The method of claim 16, further comprising:
- 2 generating one or more search windows for the remote terminal based
on the initial position estimate for the remote terminal, wherein each search
- 4 window is used to search for a respective GPS satellite.

22. A method for determining a position of a remote terminal in a
- 2 wireless communication network having included therein a plurality of
transmitting sources, the method comprising:
- 4 obtaining a set of time measurements for a set of transmitting sources,
wherein each time measurement is derived based on a transmission received at

6 the remote terminal from a transmitting source that is either an origination
source or a repeater associated with the origination source;
8 identifying a particular origination source for each received time
measurement;
10 determining an initial position estimate for the remote terminal based on
the received time measurements;
12 determining whether the origination source for at least one time
measurement used to determine the initial position estimate for the remote
14 terminal is associated with a repeater; and
generating one or more search windows for the remote terminal based
16 on the initial position estimate for the remote terminal, wherein each search
window is used to search for a respective GPS satellite.

23. The method of claim 22, further comprising:

2 compensating the one or more search windows if any time measurement
used to determine the initial position estimate for the remote terminal is
4 derived from an origination source associated with a repeater.

24. The method of claim 23, wherein the compensating includes

2 widening at least one search window to account for ambiguity due to the
repeater.

25. The method of claim 23, wherein the compensating includes

2 adjusting a time offset for at least one search window.

26. The method of claim 22, wherein the search window for a particular

2 GPS satellite is derived based on estimated closest and furthest distances
between the remote terminal and the GPS satellite.

27. The method of claim 26, wherein the estimated closest and furthest

2 distances between the remote terminal and the GPS satellite account for
ambiguity due to at least one time measurement, used to determine the initial
4 position estimate for the remote terminal, being derived from an origination
source associated with a repeater

28. The method of claim 22, wherein a time offset associated with the
2 search window for a particular GPS satellite is derived based on an estimated
average distance between the remote terminal and the GPS satellite.

29. A method for determining a position of a remote terminal in a
2 wireless communication network having included therein a plurality of
transmitting sources, the method comprising:

4 obtaining a set of time measurements for a set of transmitting sources,
wherein each time measurement is derived based on a transmission received at
6 the remote terminal from a transmitting source that is either an origination
source or a repeater associated with the origination source, and wherein a
8 plurality of time measurements are received for a plurality of transmissions
from a particular origination source or its associated repeater;

10 computing a plurality of position estimates based on the received time
measurements; and

12 selecting one of the computed position estimates as an initial position
estimate for the remote terminal.

30. The method of claim 29, further comprising:

2 deriving a metric for each computed position estimate, and

4 wherein the computed position estimate having a best metric is selected
as the initial position estimate for the remote terminal.

31. A method for determining a position of a remote terminal in a
2 wireless communication network having included therein a plurality of
transmitting sources, the method comprising:

4 obtaining a set of time measurements for a set of transmitting sources,
wherein each time measurement is derived based on a transmission received at
6 the remote terminal from a transmitting source that is either an origination
source or a repeater associated with the origination source;

8 computing a plurality of position estimates based on the received time
measurements and a plurality of network hypotheses, wherein each network
10 hypothesis corresponds to a respective combination of origination sources and
repeaters hypothesized to be the transmitting sources for the plurality of time
12 measurements used to compute the position estimate for remote terminal; and

14 selecting one of the computed position estimates as an initial position
estimate for the remote terminal.

32. The method of claim 29, further comprising:

- 2 for each network hypothesis, if a particular time measurement is
hypothesized to be from a repeater and not an origination source,
4 compensating for delays associated with the repeater.

33. The method of claim 32, wherein the compensating for delays

- 2 associated with a particular repeater includes
subtracting out a propagation delays between the repeater and the
4 associated origination source, and
subtracting out a second delays introduced by the repeater.

34. The method of claim 29, further comprising:

- 2 deriving a metric for each computed position estimate, and
wherein the computed position estimate having a best metric is selected
4 as the initial position estimate for the remote terminal.

35. The method of claim 34, wherein the metric for each computed

- 2 position estimate is based on a signal strength associated with each received
time measurement used to compute the position estimate.

36. The method of claim 29, wherein each received time measurement is

- 2 derived from a respective and different origination source.

37. The method of claim 29, further comprising:

- 2 generating one or more search windows based on the initial position
estimate for the remote terminal, wherein each search window is used to search
4 for a respective GPS satellite.

38. The method of claim 37, further comprising:

- 2 deriving a final position estimate for the remote terminal based on one
or more time measurements from one or more GPS satellites.

39. A remote terminal in a wireless communication network,
2 comprising:

- a receiver unit configured to receive, process, and digitize a received
4 signal to provide samples;

a demodulator coupled to the receiver unit and configured to receive
6 and process the samples to provide a set of time measurements for a set of
transmitting sources, wherein each time measurement is derived based on a
8 transmission received at the remote terminal from a respective transmitting
source that is either an origination source or a repeater associated with the
10 origination source;

a controller operatively coupled to the demodulator and configured to
12 receive the time measurements and further configured to receive or derive one
or more search windows based on an initial position estimate for the remote
14 terminal, wherein each search window is used to search for a respective GPS
satellite; and

16 a GPS receiver operatively coupled to the controller and configured to
search for one or more GPS satellites in accordance with the one or more search
18 windows.

40. The remote terminal of claim 39, further comprising:

2 a signal quality measurement unit operatively coupled to the
demodulator and configured to derive an estimate of a signal strength for each
4 transmission used to derive a time measurement.

41. The remote terminal of claim 39, further comprising:

2 a modulator operatively coupled to the controller and configured to
receive and process the set of time measurements; and
4 a transmitter unit operatively coupled to the modulator and configured
to transmit the set of time measurements.

42. A processing unit in a wireless communication network, comprising:

2 a transceiver configured to exchange data with a network entity;
a receive data processor coupled to the transceiver and configured to
4 receive from a remote terminal a set of time measurements for a set of
transmitting sources, wherein each time measurement is derived based on a
6 transmission received at the remote terminal from a transmitting source that is
either an origination source or a repeater associated with the origination source;
8 and

a controller coupled to the receive data processor and configured to
10 determine whether the remote terminal is under a coverage of a repeater within

the network and to derive an initial position estimate for the remote terminal
12 based on the received time measurements.

43. The processing unit of claim 42, wherein the controller is further
2 configured to generate one or more search windows for the remote terminal
based on the initial position estimate for the remote terminal, wherein each
4 search window is used to search for a respective GPS satellite, the processing
unit further comprising:

6 a transmit data processor coupled to the controller and the transceiver
and configured to receive and forward the one or more generated search
8 windows to the transceiver for transmission to the remote terminal.

44. The processing unit of claim 42, wherein the controller is further
2 configured to

compute a plurality of position estimates based on the received time
4 measurements and a plurality of network hypotheses, wherein each network
hypothesis corresponds to a respective combination of origination sources and
6 repeaters hypothesized to be the transmitting sources for the plurality of time
measurements used to compute the position estimate for remote terminal, and

8 select one of the plurality of computed position estimates as the initial
position estimate for the remote terminal.

45. The processing unit of claim 42, further comprising:

2 a data storage unit configured to store a list of probable origination
sources for each repeater within the network, and

4 wherein the controller is further configured to determine whether the
remote terminal is under the coverage of a particular repeater in the network by
6 comparing a list of originating sources for the received time measurements
against the list of probable origination sources for each repeater within the
8 network.